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Dangerous behavior of batteries in the natural environment and countermeasures

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Abstract: In order to achieve the long-term goal of low carbon emissions, more and more batteries are being used in our daily lives and in a wide range of applications, bringing great convenience as well as potential hazards. This paper makes recommendations for sustainable environmental protection based on the hazards that batteries have caused since. Metals are an important part of batteries and the damage caused by unreasonable recycling can be significant and permanent, so this paper makes some suggestions on how to improve this issue in the hope of sustainably protecting the environment. This paper discusses the damage caused by batteries being disposed of in soil, which is rich in metal elements that cannot be broken down by the soil and enter the human body through the biological chain. The damage caused by disposal in water sources may be direct in the water organisms and may eventually enter the human body through the food chain, or may even contaminate water sources directly. The most direct damage to the human body is reflected in the corrosive nature of batteries, especially for young children, who can be permanently damaged by accidental swallowing, while some metal poisoning can even directly bring about some damage to DNA. The paper concludes with recommendations to address these issues from three different perspectives: national, corporate and individual. The paper builds on these perspectives in the hope that it will ultimately contribute to emissions reduction and sustainable development.

Keywords: batteries, metals, environment, sustainable future, biological chain.

1. Introduction

In order to achieve the goal of low carbon emissions, there is a growing demand for batteries, which are used in a variety of applications such as portable electronics and powering some vehicles, and the production of batteries is increasing every year. However, if these batteries cannot be disposed of, they can cause serious difficulties for water sources, soil environment, etc. The harm caused by improper and random disposal can be permanent for humans and the environmental damage can be long-term, so it is important to keep a serious attitude towards the issue of battery hazards.

Therefore, the public needs a means to recycle batteries, which are structured as: positive electrode, negative electrode, diaphragm and electrolyte. the most noteworthy of which is the metal content inside, which is a non-renewable mineral resource and therefore must be recycled properly. In addition, the failure to recycle well can bring great harm to human beings. The soil is the environment in which human beings live, and what is planted on it is a source of food for human beings, a fertile land is what

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brings good harvests, but when the battery appears in the soil, the harm brought not only affects the food, but also brings harm to the human body. The effects of the environment are complex and water can also affect the soil, causing as much or more environmental damage. Of course, river and sea life can also be harmful to humans when contaminated with metals from batteries. Improper use of batteries by humans, accidental swallowing, can cause permanent damage. There is therefore an urgent need measures to address this problem. These problems need to be tackled on multiple levels and from multiple perspectives. In terms of national policy, in addition to the existing policies, we need to continuously improve our national management capacity. The state has the ability to regulate, entrepreneurs will be guided by policies to solve and improve similar problems, and entrepreneurs need to improve their technological innovation, recycling capacity and so on. The public is the largest and most powerful group of people, so individual members of the public also need to do what they can to deal with these problems, starting with raising awareness and sorting out battery problems. Only if we are aware of the dangers posed by batteries and address them in a variety of ways can we deal with the adverse effects of batteries in a reasonable way.

This article looks at how we should recycle these redundant batteries in three different dimensions, by analyzing the hazards they pose, the techniques used to recycle them and how we should recycle them in the future. Through some analysis of the hazards and some suggestions for battery recycling, this paper hopes to contribute to the sustainable conservation and development of the environment.

2. Hazards of batteries

2.1. Battery hazards to soil

Batteries are one of the indispensable tools for our daily use. In terms of their use, they can be divided into residential and industrial batteries, but in terms of current usage, we use a lot of them. The recycling of used batteries can have a detrimental effect if they are not handled properly. When used batteries are buried in the soil, the permeates from the used batteries can directly contaminate the soil and affect it, making it almost unusable, as shown in Fig. 1. If the soil contains too many heavy metals that cannot be broken down by the microorganisms in the soil, the heavy metals can only continue to accumulate and become increasingly toxic, which can affect the growth of plants; they can even affect human health through the food chain; some relevant studies have shown that the heavy metal liquid from used batteries in the soil does not come out of the soil quickly. Due to the construction of batteries, which are often made up of various types of metals, the source of heavy metal contaminants in Chinese soil is likewise a source of materials for batteries. Due to the promotion and large-scale use in new energy vehicles and due to the limitations of the life cycle of batteries, there may be large volumes of used batteries, such as lithium batteries, in the future [1]. The consequences of too many metals in the soil are equally dire. China is a large agricultural country and has been the subject of great national concern. The growth of crops is affected by the soil and batteries buried in the soil can reduce the amount and even the quality of vegetation (Fig. 2) [2]. Some data show that China loses 20 billion RMB per year in agricultural production due to heavy metal contamination of the soil [2]. Batteries discarded in the soil are affected not only by the growth of plants, but also by the possibility of entering the human body and causing some harm in the form of a biological chain. Previous studies have linked high concentrations of copper and zinc in land, water and food to high rates of liver cancer in the Yangtze River Delta region of China [3]. In Henan, Shanxi and other parts of China, cancer has also been associated with high concentrations of Cu, Zn, V and Zr in the soils of the affected areas. In addition, some studies have shown that it is also possible that cadmium (Cd) is present in the soil that causes kidney damage [4]. Batteries are a development of human technology and recycling properly can be sustainable, but discarding or even burying them in the soil may cause greater damage to humans.

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Figure 1. Highly contaminated land with heavy metals [5].



Figure 2. Plant growth on metal-affected land [5].

2.2. Battery damage to water

The danger of batteries is not only present in the soil but also in water sources. The quality of nearby environmental media may be affected by the transformation and movement of contaminants from the soil into surface water, groundwater and the air environment [6]. Metal contamination can be amplified and enriched thousands of times if contamination from the soil enters water bodies and passes from them to the human body through the biological chain. If some metals enter a water body due to some random human discard, then it can damage the ecology of the water body and contribute to metal pollution. These metals are present in the environment in various forms, including air, water, soil and food. Although not present in high concentrations in various surface waters, fish and other aquatic plants and animals exhibit significant bioaccumulation [7]. The bioconcentration properties of pollutants in the biological chain not only bring about a reduction in the quality of organisms in the water, but also lead to a reduction in the quality of organisms in the water and ultimately through the biological chain to the human body. Some data show that 1 button battery can make 600 tonnes of water undrinkable, which is equivalent to a person's lifetime of drinking water. Water contaminated with metals, which can no longer be used properly by people, cannot be poured into the soil, otherwise it will cause a new round of bioconcentration into the soil, which may affect the survival rate of plants, and may also enter the human body and affect human health.

2.3. The dangers of batteries to humans

There are many types of batteries in everyday life and almost every one of them contains the metal. But it is not uncommon for batteries to pose a direct hazard to humans, with accidental swallowing a common occurrence. Lead is so toxic that it can affect the intellectual development of children, and for adults, exposure to lead can lead to kidney disease and reduced neurological function, making lead poisoning a terrible thing in the long run[8]. In our daily lives, electronic devices contain batteries which are high in energy density and small. If these batteries are accidentally swallowed, it is very easy to

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cause serious esophageal damage, even permanent damage. This damage usually occurs as a result of accidental ingestion by some infants and children, with young children being at higher risk of accidentally ingesting batteries as they are still developing this reflex [9]. Oral ingestion of button batteries can lead to serious conditions, including mediastinitis, spondylitis, and even death. These conditions range from minor mucosal damage to esophageal perforation leading to stricture, tracheoesophageal fistula, vocal cord paralysis and even stricture and death [10-12]. Metal contamination enters water bodies and affects the organisms in the water through the biological chain. If these contaminated organisms are food consumed in large quantities by humans over a long period of time, such as fish, they can accumulate these metal contaminants and affect human health. Heavy metals are known to cause histopathology and genotoxicity [13]. Contaminated heavy metals have been shown to cause severe tissue damage, nuclear abnormalities and DNA damage in the liver and kidneys of contaminated organisms, and any such cycle could be irreparably damaging once it is carried over to humans [13].

3. Measures

Now that the use of batteries is at a new peak, it is important that we pay attention to the recycling of batteries. The recycling of batteries is not only a secondary use of some of the metals in batteries, but also a way of protecting environmental resources. The continuous development of batteries contains our good wishes for low carbon emission reduction, but if the subsequent recycling is not done properly it will lead to a new round of environmental pollution and cause new environmental problems.

3.1. Recycling technology

Recycling properly must be done initially in order to solve this issue. Pyrometallurgical and hydrometallurgical processes are the two primary methods for recycling lithium-ion batteries. To recover cobalt and nickel alloys, pyrometallurgical processing uses high temperature melting techniques. Chemical leaching is used in hydrometallurgical processes to speed up parent metal recovery [9]. They should be investigated and developed further in the future, along with biological recovery techniques. Dry recovery, which entails physical sorting and high temperature pyrolysis, is the direct recovery of materials or valuable metals without the use of a medium, such as a solution. Wet recycling: This method primarily uses chemical reactions to process used batteries through crushing, sorting, leaching, and recovery. The biological recovery method primarily makes use of the leaching effect of microorganisms to selectively dissolve and turn useful system components into soluble compounds. This separation of target components from impurity components allows for the recovery of valuable metals like lithium, cobalt, and nickel.

3.2. Policy

In the beginning, many firms prioritized increased windfall profits over protecting the environment. In the beginning, many firms prioritized increased profit over environmental protection. Now, it is making sustainability and environmental problems more prominent. As the phrase goes, "you can't construct a forest out of a single tree," it is important to keep in mind that the three perspectives of the government, business, and public are intertwined. Each perspective serves a vital purpose. The Chinese government now places a high value on reducing environmental pollution from old power batteries. Therefore, it is crucial to establish a stricter regulatory system for power battery recycling at the institutional level, crack down on illegal recycling practices, cut off the sources of power battery recycling that are illegal, and make sure that authorized and compliant power battery recycling businesses can fully exploit their intended environmental effects [14]. From a high level, we have a stringent mechanism to control such issues, while also suggesting that ongoing recycling routes are required. On the other hand, expand and widen the channels for recycling power batteries that are acceptable and permitted. As a result, China should vigorously widen and develop legal and compliant recycling routes while enforcing existing laws against unlawful recycling practices [14]. In additionally, the government must implement some subsidy policies, particularly for businesses that offer cutting-edge and environmentally friendly

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technologies. For instance, the government can provide subsidies to the new energy vehicle industry and foster its growth through subsidy requirements, which can produce Due to ever-stricter regulations on reducing exhaust CO_2 emissions, automakers are currently creating and marketing zero-emission or low-emission vehicles [15]. In order to promote the ongoing development of fundamental recycling technologies and to offer as well as self-help a decent and viable recycling sector, the government must continue to strengthen its support for the formal battery recycling industry.

3.3. Corporate

Recycling enterprises should continue to strengthen the intelligent transformation of recycling equipment, gradually solve the problem of high labor costs in power battery recycling, reduce costs through economies of scale, and improve their bargaining power and recycling competitiveness. Finally, it is important to strengthen publicity and education to enhance the public's environmental literacy. Power batteries can eventually flow to small workshop enterprises without recycling qualifications, the consumer link is an important factor. At present, many consumers in China lack a scientific understanding of power battery pollution and are easily tempted by the higher recycling prices of small workshops, leading to the flow of power batteries to unqualified recycling enterprises [14]. The industry as a whole still needs to upgrade some of its technologies. The industry involved in the recycling of batteries should not be used only as a technology subsidy in the name of the recycling industry, one need a large number of companies that can contribute to the recycling of batteries and have the technology to do so. There are two ways of comprehensive utilization of waste power batteries in China: one is gradual utilization, which is to reapply waste batteries to other fields with lower usage requirements after necessary testing, classification, dismantling, battery repair or reorganization, for example, electric car batteries can be applied to the two-wheeled electric vehicle market after retirement; the other is regenerative utilization, which is to dismantle, crush, sort, material repair or smelting of waste batteries The other is recycling, which is the dismantling, crushing, sorting, material repair or smelting of used batteries for resourceful use. The market for battery recycling is large, but there are not many qualified companies. In any case, the bottom line requirement for battery recycling should not be abandoned, and there is still a long way to go for battery recycling in China.

3.4. Public

As a public body, it is important to strengthen the promotion of environmental knowledge. The lack of environmental awareness often makes us overlook the importance of environmental protection. The consumer aspect is an important factor in the ability of power batteries to end up in small workshops that are not qualified to recycle them. At present, many consumers in China lack scientific understanding of power battery pollution and are easily tempted by the higher recycling prices of small workshops, leading to the flow of power batteries to unqualified recycling enterprises. Human must raise the environmental awareness of the general public groups, but also the corresponding policies, uploading, with solid legal support, and a more soft power self-environmental awareness of the existence of [14]. It is worth raising the point that many regions in China have already started to separate their waste, but in practical terms, not many have actually implemented it. The first step to recycling should start with sorting, it is unthinkable that we need to find the batteries that need to be recycled from a pile of rubbish. Sorting is only the beginning of recycling if it is really implemented for everyone. Appropriate separation of domestic waste at the household level, where the crucial functions of citizens are recognized by the European Commission in its adopted Circular Economy Package, is therefore critically important on the achievement of a circular economy [16]. Therefore, the most basic and vital thing the public can do is to start recycling by sorting.

4. Conclusions

With the passage of time, it is almost impossible to return to the completely natural way of life of the past, so there is bound to be exploitation and use of various resources, and of course the dangers of inappropriate use are enormous, from damage to the soil to the growth and quality of plants, which can

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be harmful to humans. The contamination of these metals is even more prevalent in water sources, where these organisms are themselves present, and where the water source may also affect the soil. And this metal contamination increases as the biological chain decreases from level to level. Batteries are also a direct hazard to humans, whether they are accidentally ingested or occur through the biological chain. Furthermore, governments must provide policies and help to implement recycling, and companies must adhere strictly to these rules in order to improve the long-term competitiveness of recycling, rather than seeing only short-term benefits. For individuals, the first step is to raise their awareness and realize that the first step in recycling is to start at the source, to do a better job of sorting and to raise awareness of recycling. Through some enumeration, some of the dangers that batteries can pose are clarified, some suggestions are made for their recycling and the promotion of sustainable development for the environment.

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